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BALLARD

***A New Winter-Hardy Selection From
Pentagon Oats for Use in Hybridization^{1/}***

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Oat breeders are primarily interested in developing improved oats for release to growers, but they also are seeking varieties that will serve as better parents in crosses to produce new varieties.

Ballard is the most recent notable winter oat selection from Pentagon, which has an outstanding record as a parent. Pentagon has never been grown commercially, but already 15 varieties released to growers trace their origin to it.

Ballard is superior to all other Pentagon derivatives in winter hardiness, yielding ability, vegetative vigor, and resistance to soil-borne mosaic. But like Pentagon, because of its very weak straw, Ballard too seems destined for use only as a parent. Numerous promising selections already have been obtained from Ballard crosses.

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Agricultural Research Service
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Growth Through Agricultural Progress

HISTORY OF PENTAGON AND BALLARD

On September 25, 1912, C. W. Warburton, then in charge of oat research in the U. S. Department of Agriculture, received 5 ounces of Fulghum oat seed from E. F. Cauthen, of Auburn, Ala. Warburton assigned C. I. No. 699 to this lot of oats. Varieties derived from C. I. 699 have been grown on millions of acres from Virginia and the Carolinas westward to Texas and Oklahoma.

In 1920, T. R. Stanton,^{3/} working at Arlington Experimental Farm in Virginia, made 15 panicle selections from his plots of Fulghum. These he selected because they were "more winter in type." Three of these 15 selections were assigned C. I. 2498, C. I. 2499, and C. I. 2500, respectively. None of these three oats was ever released to growers.

To date, C. I. 2498 has contributed nothing of special interest; but Lemont and Crater, produced in North Carolina and Oregon, respectively, and Wintok, in Oklahoma, resulted from crosses of which C. I. 2500 was one parent. Lemont and Crater were of minor importance, but according to Coffman,^{4/} Wintok was the most winter-hardy oat variety for many years. Wintok was much used as a parent in oat crosses. From some Wintok crosses, valuable winter oat varieties have resulted; and from others, promising spring oat selections have been produced.

However, C. I. 2499, later named Pentagon^{5/} by Stanton,^{6/} has been of even greater value as a parent than C. I. 2500.

DERIVATIVES OF PENTAGON

In 1929, Stanton sent seed of several winter oat varieties including Pentagon to N. I. Hancock, at Knoxville, Tenn. Hancock observed that Pentagon was not fully homozygous and selected 1,000 panicles for sowing in head rows in the fall of 1930. Three of these selections, later named Fulwin, Forkeddeer, and Tennex, became valuable varieties.

^{3/} Stanton, T. R. Breeding winter oats for the south. J. Am. Soc. Agron. 18:804-814. 1926.

^{4/} Coffman, Franklin A. Results from uniform winter hardiness nurseries of oats for the five years 1947 to 1951, inclusive. Agron. J. 47:54-57. 1955.

^{5/} The name Pentagon was chosen because the famous Pentagon building now occupies part of the Arlington Experimental Farm area on which the original "winter type" Fulghum selections were made.

^{6/} Stanton, T. R. Oat identification and classification. USDA Tech. Bull. 1100. 1955.

These high-yielding and winter-hardy varieties were grown on farms in Tennessee and adjacent states, but all were somewhat lacking in straw strength. All three have been much used by oat breeders as parents in crosses. Named varieties derived from crosses with these three oats are:

Fulwin:	Arlington, Atlantic, Bronco, Mustang, Roanoke, Fairfax, and Sumter.
Forkedeer:	Dubois and Norline.
Tennex:	Le Conte and Blount.

An unnamed selection from Pentagon is a parent of the Arkwin variety.

Pentagon strain Ky. 45-65 (C. I. 6980) is now named Ballard. It is the progeny of a head selection from Pentagon made by L. M. Josephson, in 1945, at Lexington, Ky.

Results already obtained indicate that Ballard is proving to be even more valuable as a parent than any of the previously named strains of Pentagon because of its superior hardiness, vigor, yielding ability, and disease resistance.

BALLARD'S RECORD

Ballard was tested in replicated rod-row trials at Lexington, Ky., by D. A. Reid, 1948-50. Later, from 1957-60, following the discovery of Ballard's exceptional winter hardiness, it was again grown at several locations in Kentucky by the junior author. Results are shown in table 1.

In 1950, at the suggestion of the senior author, D. A. Reid, then of the Kentucky Station, sent seed of Ballard and other selections to C. S. Bryner, who at that time had charge of the oat experiments in Pennsylvania. The objective was to determine the relative hardiness of those oat strains under the more rigorous winter conditions in Pennsylvania. Bryner grew the oats from 1951-54 and noted Ballard's unusual hardiness. Ballard has been tested in the uniform hardiness nursery for 6 years. In over 180 trials in which differential killing occurred, Ballard was slightly more winter hardy than Wintok, long the most hardy oat in America. It was 25 percent more hardy than Pentagon and nearly 10 percent more hardy than Fulwin.

In more than 70 comparisons in the Northern Regional Winter Oat Yield Nursery from 1957-60, Ballard outyielded Wintok by an average of 8 bushels per acre. The average test weights for Ballard and Wintok have been similar. In some 50 nurseries, Ballard survived about 5 percent better than Wintok, grew 4 inches taller, and lodged no more severely.

TABLE 1.--Comparison of Ballard and Wintok oats grown in Kentucky for two different periods. (Number in parentheses after each value indicates number of tests.)

Item	Lexington, Ky. 1948-50		Several locations in Kentucky, 1957-60	
	<u>Ballard</u>	<u>Wintok</u>	<u>Ballard</u>	<u>Wintok</u>
Yield per acre -- bu.	73.1(3)	77.4(3)	65.2(11)	57.2(11)
Test weight -- lb. per bu.	34.1(3)	36.0(3)	35.8(11)	35.2(11)
Lodging -- percent	52.5(2)	53.0(2)	50.0(8)	50.5(8)
Height -- in.	43.0(3)	37.6(3)	40.5(11)	37.2(11)
Heading date	May 19(3)	May 17(3)	May 21(6)	May 19(6)
Winter survival -- percent	96.0(2)	99.0(2)	71.2(5)*	68.1(5)

* Average survival of Ballard and Wintok in 10 tests were 85.6 and 84.1%, respectively.

Although Ballard has weak straw, it is unusually vigorous. In forage tests at Beltsville, Md., during the 5-year period, 1957-61, inclusive, Ballard was outstanding in yields of both green forage and dry hay.

Ballard has been tested on soil known to be infested with soil-borne mosaic at several points. Data obtained during six seasons indicate that of all the more winter-hardy oats now known, Ballard is among the most resistant to mosaic.

USE OF BALLARD IN CROSSES

Despite the many exceptional characteristics of Ballard, its very weak straw has prevented its release to growers. However, certain hybrids from crosses of Ballard with other oat varieties having stiff straw have exceptional vigor, yield well, are highly resistant to soil-borne mosaic, and have better straw than Ballard. Whether any of these will have straw as stiff as that of Le Conte or Dubois is yet to be proved. There seems little doubt, however, that Ballard, selected in Kentucky, will prove fully as important as a parent as Fulwin, Forkeddeer, and Tennex, the three Pentagon reselelections from Tennessee. Thus, Pentagon, an unattractive oat in itself, seems destined in Ballard to continue to contribute to the northward extension of winter oats.